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Date: May 19, 2004 **Pages (including cover): 10**

To: **EXAMINER JOSEPH F. MURPHY** **Fax: 703-308-6916** **Ph:**
Art Unit 1646

From: Raymond Van Dyke **Docket No. 031896-69100**
Reg. No. 34,746

Message: **The following documents are being presented for facsimile filing in the United States Patent and Trademark Office:**

1. Transmittal
2. Response to Restriction Requirement

OFFICIAL

In re Patent Application of
Inventor(s): Kathleen H. YOUNG *et al.*
Serial No.: 10/051,841
Filed: January 17, 2002
For: Methods for Identifying Modulators of N-Type Ion Channel Inactivation
Due Date: May 19, 2004

CERTIFICATE OF TRANSMISSION [37 CFR 1.8(a)]

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Name: *Linda C. Haynes*

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/051,841
Filing Date	January 17, 2002
First Named Inventor	Kathleen H. YOUNG
Group Art Unit	1646
Examiner Name	Joseph F. MURPHY
Total Number of Pages in This Submission	
Attorney Docket Number	031896-069100

ENCLOSURES *(check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☒ **Response to Restriction Requirement**
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/ Incomplete Application
  - ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Assignment Papers *(for an Application)*
- ☐ Drawing(s)
- ☐ Declaration and Power of Attorney
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
- ☐ After Allowance Communication to Group
- ☐ Other

Remarks

☒ The Commissioner is hereby authorized to charge any additional fees required or credit any overpayments to Deposit Account No. 19-2380 for the above identified docket number.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Raymond Van Dyke, Reg. No. 34,746 Nixon Peabody LLP 401 9th Street, N.W. Suite 900 Washington, D.C. 20004-2128
Signature	
Date	May 19, 2004

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Docket No. 31896-069100 (AH98133 C1)
Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	)	
H. YOUNG *et al.*	)	Group Art Unit: 1646
Serial No.: 10/051,841	)	Examiner: Joseph Murphy
Filed: January 17, 2002	)	Confirmation No: 2237
For: Methods for Identifying Modulators of N-Type Ion Channel Inactivation	)	Date: May 19, 2004

Mail Stop **AMENDMENT**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO RESTRICTION REQUIREMENT

Sir:

In response to the Office Action mailed April 19, 2004, please amend the above application as follows.

Amendment to the claims begins on page 2 of this paper.

Remarks begin on page 8.

Amendment to the claims:

This listing replaces all prior versions and listings of claims in the application.

1. (withdrawn) A method of evaluating a compound for the ability to inhibit binding of an intracellular receptor region of an α-subunit of a voltage-gated ion channel and an amino-terminal inactivation region of an ion channel protein, comprising:

(a) contacting the compound with said intracellular receptor region and said amino-terminal inactivation region; and

(b) determining the ability of said compound to interfere with the binding of said intracellular receptor region with said amino-terminal inactivation region, wherein a decrease in said binding in the presence of said compound compared to said binding in the absence of said compound indicates that said compound inhibits binding of said intracellular receptor region to said amino-terminal inactivation region.

2. (withdrawn) The method of claim 1, wherein the voltage-gated ion channel is a potassium channel or a sodium channel.

3. (withdrawn) The method of claim 1, wherein the intracellular receptor region comprises an S4-S5 cytoplasmic receptor domain of an α-subunit of a voltage-gated channel protein, or a biologically active fragment thereof.

4. (withdrawn) The method of claim 3, wherein the voltage-gated ion channel protein is a potassium channel protein selected from the group consisting of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.6, and Kv3.4.

5. (withdrawn) The method of claim 1, wherein the amino-terminal inactivation region comprises an amino-terminal domain of a potassium channel protein or a sodium channel protein, or a biologically active fragment thereof.

6. (withdrawn) The method of claim 5, wherein the potassium channel protein is selected from the group consisting of Kvβ1, Kvβ1.2, Kvβ1.3, Kvβ3, Kv1.4, and Kv3.4.

7. (withdrawn) A method of screening a candidate compound for the ability to inhibit binding of an intracellular receptor region of an α-subunit of a voltage-gated ion channel to an amino-terminal inactivation region of an ion channel protein, comprising:

(a) adding said candidate compound to a modified host cell comprising a reporter gene; and

(b) monitoring expression of said reporter gene, wherein a decrease in expression is an indication that said candidate compound inhibits binding of the intracellular

receptor region of the α-subunit to the amino-terminal inactivation region of the ion channel protein.

8. (withdrawn) The method of claim 7, wherein the voltage-gated ion channel is a potassium channel or a sodium channel.

9. (withdrawn) The method of claim 7, wherein the voltage-gated ion channel is a potassium channel protein selected from the group consisting of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.6, and Kv3.4.

10. (withdrawn) The method of claim 7, wherein the amino-terminal inactivation region is an amino-terminal domain of a potassium channel protein selected from the group consisting of Kvβ1, Kvβ1.2, Kvβ1.3, Kvβ3, Kv1.4, and Kv3.4.

11. (withdrawn) A modified host cell comprising:

(a) a first hybrid protein comprising a DNA-binding domain of a transcriptional activator in polypeptide linkage to either (i) an intracellular receptor region of an α-subunit of a voltage-gated ion channel or (ii) an amino-terminal inactivation region of the ion channel protein; and

(b) a second hybrid protein comprising an activation domain of a transcriptional activator in polypeptide linkage to said intracellular receptor region if said DNA-binding domain is in polypeptide linkage to said amino-terminal inactivation region or to said amino-terminal inactivation region if said DNA-binding domain is in polypeptide linkage to said intracellular receptor region.

12. (withdrawn) The modified host cell of claim 11, wherein the voltage-gated ion channel is a potassium channel or a sodium channel.

13. (withdrawn) The modified host cell of claim 11, wherein the intracellular receptor region is an S4-S5 cytoplasmic receptor domain of a potassium channel protein selected from the group consisting of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.6, and Kv3.4.

14. (withdrawn) The modified host cell of claim 11, wherein the intracellular receptor region of an α-subunit comprises an amino acid sequence selected from the group consisting of:

(a) an amino acid sequence as set forth in SEQ ID NO:1, or a biologically active fragment thereof;

(b) an amino acid sequence as set forth in SEQ ID NO:2, or a biologically active fragment thereof; and

(c) an amino acid sequence which is at least 90 to 95% identical to the amino acid sequence of SEQ ID NO:1 or SEQ ID NO:2.

15. (withdrawn) The modified host cell of claim 11, wherein the amino-terminal inactivation region is an amino-terminal domain of a potassium channel protein or a sodium channel protein.

16. (withdrawn) The modified host cell of claim 11, wherein the amino-terminal inactivation region is an amino-terminal domain of a potassium channel protein selected from the group consisting of Kvβ1, Kvβ1.2, Kvβ1.3, Kvβ3, Kv1.4, and Kv3.4.

17. (withdrawn) The modified host cell of claim 11, wherein the amino-terminal inactivation region comprises an amino acid sequence selected from the group consisting of:

(a) an amino acid sequence as set forth in SEQ ID NO:5, or a biologically active fragment thereof;

(b) an amino acid sequence as set forth in SEQ ID NO:6, or a biologically active fragment thereof; and

(c) an amino acid sequence which is at least 90 to 95% identical to the amino acid sequence of SEQ ID NO:5 or SEQ ID NO:6.

18. (withdrawn) The modified host cell of claim 11, wherein said host cell is selected from the group consisting of a yeast cell, a mammalian cell, an amphibian cell, and a bacterial cell.

19. (withdrawn) The modified host cell of claim 18, wherein said yeast cell is selected from the group consisting of *Saccharomyces cerevisiae, Schizosaccharomyces pombe,* and *Pichia pastoris.*

20. (withdrawn) The modified host cell of claim 11, wherein the transcriptional activator is selected from the group consisting of Gal4, Gcn4, Hap1, Ard1, Swi5, Ste12, Mcm1, Yap1, Ace1 Ppr1, Arg81, Lac9, Qa1F, VP16, LexA, and a mammalian nuclear receptor.

21. (withdrawn) The modified host cell of claim 11, wherein the transcriptional activator is Gal4.

22. (withdrawn) The modified host cell of claim 11, further comprising a reporter gene whose transcription is dependent upon the first hybrid protein and the second hybrid protein being bound to each other, thereby reconstituting a transcriptional activator.

23. (withdrawn) The modified host cell of claim 22, wherein the reporter gene is selected from the group consisting of:

(a) genes conferring sensitivity to a chemical;

(b) genes conferring resistance to a chemical;

(c) genes complementing auxotrophies; and

(d) *LACZ*, Luciferase gene, green fluorescent protein gene, *URA*, *CAT*, *LAC1*, and *GAL80*.

24. (withdrawn) The modified host cell of claim 22, wherein the reporter gene is a HIS gene or a CYH2 gene.

25. (withdrawn) The modified host cell of claim 22, wherein

the first hybrid protein comprises a Gal4 DNA-binding domain in polypeptide linkage to an S4-S5 cytoplasmic receptor domain of an α-subunit of a Kv1.1 channel protein, or a biologically active fragment thereof;

the second hybrid protein comprises a Gal4 activation domain in polypeptide linkage to the amino-terminal inactivation region of a Kvβ1 cytoplasmic protein, or a biologically active fragment hereof; and

the reporter gene comprises CYH2.

26. (withdrawn) The modified host cell of claim 22, wherein

the first hybrid protein comprises a Gal4 DNA-binding domain in polypeptide linkage to an S4-S5 cytoplasmic receptor domain of an α-subunit of a Kv1.4 channel protein, or a biologically active fragment thereof;

the second hybrid protein comprises a Gal4 activation domain in polypeptide linkage to the amino-terminal inactivation region of an α-subunit of an Kv1.4 channel protein, or a biologically active fragment hereof; and

the reporter gene comprises CYH2.

27. (withdrawn) The modified host cell of claim 22, wherein the modified host cell is a yeast cell derived from a *Saccharomyces* organism having the genotype MATa, *gal80*, *gal4*, *his3*, *ade2-101*, *leu2-3*, *112 trp1-910*, *ura3.52 cyh*^{r} LYS2::GAL$_{UAS}$-HIS3.

28. (withdrawn) A method for identifying compounds which inhibit N-type inactivation of a voltage-gated ion channel, comprising:

(a) administering a compound to the modified host cell of claim 22 and incubating the modified host cell for a suitable period;

(b) determining whether the administration of the compound inhibits expression of the reporter gene; and

(c) identifying a compound which inhibits expression of the reporter gene as an inhibitor of N-type inactivation of said voltage-gated ion channel.

29. (withdrawn) A modified host cell comprising:

a first hybrid protein comprising an intracellular receptor region of an α-subunit of a voltage-gated ion channel and in polypeptide linkage to a first peptide of the peptide binding pair; and

a second hybrid protein comprising an amino-terminal inactivation region of an ion channel protein in polypeptide linkage to a second peptide of the peptide binding pair;

wherein binding interaction between the first peptide and the second peptide in the modified host cell causes activation of a signal transduction pathway in said modified host cell.

30. (withdrawn) The modified host cell of claim 29, wherein the voltage-gated ion channel is a potassium channel or a sodium channel.

31. (withdrawn) The modified host cell of claim 29, wherein the intracellular receptor region is an S4-S5 cytoplasmic receptor domain of a potassium channel protein selected from the group consisting of Kv1.1, Kv1.2, Kv1.3, Kv1.4, Kv1.5, Kv1.5, and Kv3.4.

32. (withdrawn) The modified host cell of claim 29, wherein the amino-terminal inactivation region is an amino-terminal domain of a potassium channel protein selected from the group consisting of Kvβ1, Kvβ1.2, Kvβ1.3, Kvβ3, Kv1.4, and Kv3.4.

33. (withdrawn) The modified host cell of claim 29, wherein said host cell is selected from the group consisting of a yeast cell, a mammalian cell, an amphibian cell, and a bacterial cell.

34. (withdrawn) The modified host cell of claim 33, wherein said yeast cell is selected from the group consisting of *Saccharomyces cerevisiae, Schizosaccharomyces pombe,* and *Pichia pastoris.*

35. (withdrawn) The modified host cell of claim 29, wherein said first peptide of the peptide binding pair is either an effector molecule or a cell compartment localization domain, and wherein said second peptide of the peptide binding pair is (i) a cell compartment localization domain if said first peptide is an effector molecule or (ii) an effector molecule if said first peptide is a cell compartment localization domain.

36. (withdrawn) The modified host cell of claim 35, wherein said effector molecule is a guanine nucleotide exchange factor and said cell compartment localization domain is a plasma membrane localization domain.

37. (withdrawn) The modified host cell of claim 36, wherein said guanine nucleotide exchange factor is an SOS and said plasma membrane localization domain is a myristoylation signal.

38. (withdrawn) The modified host cell of claim 35, wherein said effector molecule activates an indicator molecule selected from the group consisting of a MAP kinase, a RAS protein, a JAK protein, a JNK protein, and IRS-1 protein.

39. (original) A polynucleotide encoding a DNA-binding domain or an activation domain of a transcriptional activator and comprising a nucleotide sequence selected from the group consisting of:

(a) the nucleotide sequence of SEQ ID NO:3;

(b) nucleotide sequence of SEQ ID NO:4;

(c) a nucleotide sequence which is at least 90% identical to the nucleic acid of (a) or (b) and which encodes a peptide that is capable of binding to an amino-terminal inactivation region of an ion channel protein; and

(d) a nucleotide sequence which is degenerate as a result of the genetic code to a nucleic acid defined in (a) or (b) and which encodes a peptide that is capable of binding to an amino-terminal inactivation region of an ion channel protein.

40. (original) A polynucleotide encoding a DNA-binding domain or an activation domain of a transcriptional activator and comprising a nucleotide sequence selected from the group consisting of:

(a) the nucleotide sequence of SEQ ID NO:7;

(b) nucleotide sequence of SEQ ID NO:8;

(c) a nucleic acid molecule which is at least 80% identical to the nucleic acid of (a) or (b) and which encodes a peptide that is capable of binding to an intracellular receptor region of an α-subunit of a voltage-gated ion channel; and

(d) a nucleic acid molecule which is degenerate as a result of the genetic code to a nucleic acid defined in (a) or (b) and which encodes a peptide that is capable of binding to an intracellular receptor region of an α-subunit of a voltage-gated ion channel.

41. (original) An expression vector comprising the polynucleotide of claim 39.

42. (original) An expression vector comprising the polynucleotide of claim 40.

43. (original) A host cell transfected or transformed with the expression vector of claim 41.

44. (original) A host cell transfected or transformed with the expression vector of claim 42.

Docket No. 31896-069100 (AH98133 C1)
Patent

REMARKS

Claims 1-44 are pending. In response to the Restriction Requirement set forth in the Office Action mailed April 19th, Applicants hereby elect Group VIII (claims 39-44), drawn to a polynucleotide, a vector and a host cell transformed with the vector, for examination. Applicants reserve the right to file one or more divisional applications covering the subject matter of the non-elected claims.

A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, are presented with an appropriate defined status identifier. The amendment does not go beyond the original disclosure of the application.

In accordance with the foregoing, examination on the merits is requested. Should there be any questions or should the Examiner wish to discuss any proposal to expedite prosecution, the Examiner is invited to contact the undersigned representative at the telephone number shown below.

If there are any fees due in connection with the filing of this response, please charge the fees to Deposit No. 19-2380.

Respectfully submitted,

Date: May 19, 2004

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